

K-3 MODULE

Unit 3: Vermicomposting Overview

Note: Approximately one month before beginning Lesson 3 in Unit 3, complete “Preparing the Decomposition Experiment” on page 106.

UNIT 3'S CONCEPT

Through vermicomposting, food waste is recycled and the compost can be used to enhance soil.

K-3 Module
Unit 3

The five lessons in this unit are:

LESSON 1: THE BASICS OF VERMICOMPOSTING

Lesson's concept: Food scraps can be recycled through vermicomposting.

In Lesson 1 students will:

- Brainstorm what they know and what they would like to know about worms.
- Set up a vermicomposting bin.
- Classify those items that can be fed to red worms and those that cannot be fed to red worms and write a poem about it.
- Design a chart with pictures of what to feed and what not to feed red worms.
- Record the weight and type of worm food and where it was placed in the worm composting bin.
- Select questions about red worms that they can research in books, on the computer, through videos, and through personal observations.

LESSON 2: GETTING TO KNOW RED WORMS

Lesson's concept: Red worms, like all other living things, “take in nutrients, give off wastes, grow, reproduce, and respond to stimuli from their environments.” (*Science Framework*, p. 116)

In Lesson 2 students will:

- List the ways to humanely observe and handle a red worm, and using the list, they will then write a song or sing a song that is already written.

- Observe a red worm by using a magnifying lens and record their observations.
- Conduct humane experiments to determine whether red worms prefer light or dark.
- Practice measuring on gummy worms and then measure live red worms, chart these measurements, and develop a graph to compare the length of 20 red worms.
- Draw pictures or write stories about red worms.

LESSON 3: CYCLES IN NATURE AND RED WORM DEVELOPMENT

Lesson's concepts:

- All living things create waste. In natural systems, waste is broken down by chemical and physical means and can be used by other living things. (“Conceptual Matrix for Integrated Waste Management Education”)
- In the cycles that occur in nature, materials, such as nutrients, are recycled. Worms play an important role in recycling nutrients.

In Lesson 3 students will:

- Examine the stages of decomposition of the items they buried at the beginning of this unit.
- Design a game to model the water cycle and identify a water cycle in the worm bin.
- Illustrate the stages of growth of a red worm.

- Determine the role red worms play in the nutrient cycle.
- Make a mural of cycles in a well-functioning vermicomposting bin.

LESSON 4: THE EFFECTS WORMS HAVE ON SOIL

Lesson's concepts:

- Red worms turn food waste into compost that can be used to improve soil.
- People and other living things depend on soil.

In Lesson 4 students will:

- Observe, touch, and describe soil.
- Examine and describe worm castings and compare them to soil.
- Discuss the effect worms have on soil and how their actions may benefit other organisms.
- Sing a song about the importance of worms and soil to people.
- Design collages showing ways people use soil.

LESSON 5: USING COMPOST AND PROMOTING VERMICOMPOSTING

Lesson's concepts:

- Red worms turn food and paper waste into compost that can be used to enrich soil.
- People can participate in actions that enhance their environment.

In Lesson 5 students will:

- Harvest the vermicompost from the worm bin.
- Conduct an experiment to test whether worm compost affects plant growth.
- Read or listen to *Miss Rumphius* by Barbara Cooney and *Johnny Appleseed* by Eva Moore and discuss the special things each character did to improve the environment.
- Make a red worm mascot, puppet, or clay model, and use these to share what they know about red worms and vermicomposting.
- Write poems, songs, and stories or design murals, illustrations, and posters to teach others about the importance of vermicomposting.

Required Books to Implement Unit 3

• For Lesson 1:

Kalman, Bobbie, and Janine Schaub. *Squirmy Wormy Composters*. Primary Ecology series. New York: Crabtree Publishing Company, 1992.

• For Lesson 5:

- Cooney, Barbara. *Miss Rumphius*. New York: Viking, 1982.
- Moore, Eva. *Johnny Appleseed*. Illustrated by Beatrice Darwin. New York: Scholastic, Inc., 1970.

PROJECTS

Projects provide hands-on experiences for students. Some lessons in this unit are project-based and encourage students to apply what they have learned in the classroom. Some project-based lessons are service-learning oriented, and in these lessons students participate in improving the environment in their school and community.

The following describe five projects that address this unit on vermicomposting. Examples are given of schools that participate in vermicomposting. Teachers are encouraged to select one of these projects with their students or to have their students develop one of their own. If students develop an applicable project, they and their teachers are encouraged to send a description of the project to the California Integrated Waste Management Board, Office of Integrated Education, MS-14A, 1001 I Street, P.O. Box 4025, Sacramento CA 95812-4025.

- **Project 1:** Students compile a class booklet, complete with illustrations, describing the first time they saw a red worm. The booklet could include the name of each student in the class, followed by a description written or dictated by the named student. For example, "The first time Charles saw a worm . . ." ; "the first time Marina touched a worm . . ." (Lesson 2).
- **Project 2:** Students plant flowers in planters on the school grounds (Lesson 4), plant shrubs and trees to beautify their school grounds (Lesson 5), or develop a school garden (Lesson 4).
- **Project 3:** Students put together information about red worms and vermicomposting in a script for a puppet show. Arrange for your

students to go to other classes to present their puppet show about red worms and vermicomposting. This show can also be presented during a school assembly and at the school's open house (Lesson 5).

- **Project 4:** Students package the vermicompost and sell it to parents or other community members. Students could also include information in the packages about the benefits of vermicomposting or how to build and maintain a worm bin (Lesson 5).
- **Project 5:** Students organize and conduct an annual worm festival. They could develop stations for students from other classes to visit. A demonstration on how to vermicompost can also be included (Lesson 5).
- **Other Projects**

Lesson 1 of Unit 3 is project-based, focusing on vermicomposting as the class project.

Marguerite Hahn Elementary School, Cotati-Rohnert Park Unified School District¹

Sharon Janulaw's kindergarten class at Marguerite Hahn Elementary School prepared a vermicomposting bin to be used to process food waste from students' snacks. It is one foot deep by two feet wide by three feet long with a lid. Students take turns caring for the worms, making certain that the worm bin is not too hot or too dry. This bin will be displayed at open house, and the students will explain to their parents how to set up and care for the worm bin and show how food waste can be changed by the worms into a soil amendment.

The schools described below have classroom or school-wide vermicomposting bins and could be contacted for more information. The information on the schools from the San Francisco Unified School District was provided by Natasha Stillman, School Education Coordinator, Solid Waste Management Program, City and County of San Francisco. She oversees the San Francisco Recycling Program.

Bret Hart Elementary School, San Francisco Unified School District

Bret Hart Elementary School has a garden that is used by students to study science, social science, mathematics, and language arts. The garden was recently replanted, providing an opportunity for the integration of worm composting. The San

¹Submitted by Sharon Janulaw, kindergarten teacher and field tester for *Closing the Loop*, Marguerite Hahn Elementary School, Cotati-Rohnert Park Unified School District.

Francisco Recycling Program provided outdoor worm bins and introductory classes both to teachers and to students. Currently, two bins are being used several times a week when the students collect food waste from the cafeteria.

Cesar Chavez Elementary School, San Francisco Unified School District

In 1996 a composting program at Cesar Chavez Elementary School was initiated by three teachers as an addition to the garden that was already in place. In 1997 an Americorps volunteer associated with the school took over the project. The school now has seven worm bins, five of which were cut down to accommodate the smaller children. An average of 5–10 pounds of compostable food is collected every week. The worm castings are used as fertilizer in the school's garden.

Dr. Charles R. Drew Elementary School, San Francisco Unified School District

At Dr. Charles R. Drew Elementary School, two worm boxes are kept in a courtyard adjacent to the cafeteria. Two buckets for collection are kept in the teachers' lounge, along with a scale for weighing the amount being composted and newspaper for the worm bins. Students from Kathy Harriman's third-grade class take turns collecting the compostable food waste from the cafeteria and place it in the worm bins on a daily basis.

John Muir Elementary School, San Francisco Unified School District

Initiated by the school's garden coordinator in 1996, with help from the San Francisco Recycling Program, John Muir Elementary School now has the beginnings of a worm composting program in the school's garden, located a half-block away from the school. A fifteen-student "Worm Patrol" team collects food waste from one of the lunch periods. The food is then distributed between a worm bin and a basic bin. The worm castings and compost from the basic bin are used as fertilizer and soil amendment in the school's garden. The garden is used each week by the garden coordinator for lessons on gardening and composting.

Lawton Elementary School, San Francisco Unified School District

The composting program at Lawton Elementary School includes two 4- by 4-foot vermicomposting bins and two basic composting bins. The program consists of teams of six students in grades three through eight that rotate over a two-week period to monitor the process, collect food, and place food in the worm bins. In the 1996–97 school year, an average of 49 pounds of material was composted every week. The compost is used in the school's garden and in the landscaped areas of the school.

Rooftop Elementary School, San Francisco Unified School District

Having a well-established garden at Rooftop Elementary School allowed both worm and basic composting to be integrated easily. The school now has three 4- by 4- by 2-foot worm bins for fruit and vegetable scraps and several basic composting bins for garden trimmings. The students eat in the school garden, making collection easy. An average of 15–20 pounds of food waste is collected each week. The worm castings and basic compost are used in the garden.

Weaverville Elementary School, Weaverville Elementary School District²

Sue Odell's third-grade class and a fourth-grade class at Weaverville Elementary School have been involved in a vermiculture project for several years. The students separate lunch products into what the worms could eat and what we need to "throw away." They included the entire school in the project. "We found that our primary children had two to three times the waste material of the older students. We talked about ways to reduce the waste. With more school participation, including buy-in from cafeteria workers, we

²Submitted by Sue Odell, third- and fourth-grade teacher and field tester for *Closing the Loop*, Weaverville Elementary School, Weaverville Elementary School District.

could lower our throw always even more."

Laytonville Elementary School, Laytonville Unified School District³

Putting worms to work has made vermicomposting (composting with worms) successful at the Laytonville Unified School District in Mendocino County. Students from the district's elementary and middle school separate their lunch waste into nonprotein "worm food" (i.e., no meat or dairy products), paper bags, aluminum cans, glass, milk cartons, and garbage. Both the worm food and paper bags (after being shredded) are taken to the worm bins located in the school garden. Under adult supervision, middle school students monitor the bins and record the worms' activities. Students also built four 32-square foot worm bins last spring out of redwood and plywood. A chart showing the amount of compost produced is posted in the cafeteria; the compost and recycling program has reduced school garbage by 60-80 percent.

³"Laytonville Composts," *Reusable School News*. Sacramento: Integrated Waste Management Board (spring 1993).



Vermicomposting bins at Rooftop Elementary School, San Francisco Unified School District.

RECOMMENDED TIME LINE AND ACTIVITIES FOR UNIT 3: VERMICOMPOSTING

Day 1	Buy bin and send for worms. ¹ Buy or send for required books for the unit.
Day 2 (and at least one month before doing Lesson 3)	Do “Preparing the Decomposition Experiment” to prepare for Lesson 3.
Before doing Lesson 1	Teach students about the needs of living things in order for them to live. ² Collect newspapers or other paper for the worm bin.
When you get the worms (within two days after receiving the worms)	Do Lesson 1.
Within two weeks of Lesson 1	Do Lesson 2.
Approximately one month after doing “Preparing the Decomposition Experiment”	Do Lesson 3.
Any time after Lesson 3	Do Lesson 4.
Throughout the next two to three months	Do parts of Lesson 5.
When compost is ready	Complete Lesson 5.

¹When ordering the worms, find out how long it will take for you to get them.

²Because this unit focuses on vermicomposting and in order to keep this unit relatively short, we have not included certain lessons that already exist in most science programs. These include the needs of living things. Before beginning Lesson 1, you will need to select and implement an activity to teach students what living things need in order to live.

Note: This is a time line for doing the activities in Unit 3, but you should consider using the worm bin throughout the year. If you do not want to continue to maintain the worm bin, please give it to another teacher or to a responsible student to care for. Another alternative is to release the red worms in a compost pile.

PREPARING THE DECOMPOSITION EXPERIMENT

Note: Do the following approximately one month before you begin Lesson 3 of Unit 3 on cycles.

MATERIALS

- ___ Dampened bread (Use bread that does not contain preservatives.)
- ___ Resealable plastic sandwich bag
- ___ Samples of the following pieces of trash (should be approximately the same size):
 - ___ Plastic
 - ___ Aluminum
 - ___ Cardboard
 - ___ Fruit or vegetable
 - ___ Yard waste like leaves
 - ___ Classroom paper (copy paper, binder paper, or construction paper)
- ___ Approximately ten to twelve cups of garden soil (Do not use sterilized potting soil.)
- ___ A container for the soil (e.g., a one gallon milk or water jug)
- ___ Piece of butcher paper on which to record students' predictions

PROCEDURE

- A. Place a piece of dampened bread in a resealable plastic sandwich bag and have students look at it each day as it decomposes. They can record their observations on a piece of paper set up next to the bread in the bag.
- B. Show samples of the following pieces of trash and write the names on a piece of butcher paper:
 - Plastic

- Aluminum
 - Cardboard
 - Fruit or vegetable
 - Yard waste, such as leaves and grass clippings
 - Classroom paper
- C. Ask students to predict which items will begin to rot (decompose) in a month if buried in soil. List their predictions on the butcher paper. Keep these predictions to refer to in Lesson 3.
 - D. Ask students to select two items from the list on the butcher paper and to draw how these items look now and how they think they will look in a month. Keep these illustrations to refer to in Lesson 3.
 - E. Place garden soil in a container. Bury all six pieces of trash in the soil in the container. Plan to have students unbury and observe these items in approximately a month when you implement Lesson 3. Make sure that the soil stays damp (you might need to water the soil regularly).